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The Rainbow Pages

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Building Community with Voice Technology

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Abstract

Telecommunication networks have the power to bring people together. Unfortunately, text-based bulletin boards require personal computers as front-ends and that restricts access to only those individuals and organizations that can afford to purchase computers. A voice bulletin board, on the other hand, uses any touch-tone telephone as a front end, and most people in this country already own or can afford to purchase a touch-tone telephone. This paper describes the rationale for and design of a free, public-access voice bulletin board that attempts to bring the power of computing to the people of one neighborhood in Boston.

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Introduction

There is no such thing as a poor community. Even neighborhoods without much money have substantial human resources. Often, however, the human resources are not appreciated or utilized, partly because people do not have information about each other and about what their neighborhood has to offer. For example, a family whose oil heater is broken may go cold for lack of knowledge that someone just down the block knows how to fix it.

We are developing a voice bulletin board, which we call the Rainbow Pages, for the South End, a neighborhood in Boston. It will be accessible free of charge from any touch-tone telephone. We hope that the Rainbow Pages will foster better *utilization* of human resources, which will create a material payoff. We also hope it will foster an *appreciation* of the resources available in the neighborhood, which will have a psychological payoff.

Bulletin boards of all kinds have great potential for building and maintaining communities. Universities put paper bulletin boards in corridors and lounges and the city of Cambridge, MA even has outdoor bulletin-boards on main thoroughfares. The greatest asset of a bulletin board is that the person who posts a flyer does not need to know in advance all of the people who might be interested in reading it. Complementing that feature, if a bulletin board is sufficiently well organized and has social conventions governing its use, most people who are not interested in a flyer need never even look at it. As well as disseminating information efficiently, a paper bulletin board may be a location where conversations begin: two people reading a flyer have a topic on which to begin a conversation.

A major problem with paper bulletin boards is accessibility. The people who are interested in a flyer have to pass by the bulletin board and have spare time right then to stop and read the message. Even if they read the flyer, they might forget important information unless they copy it down or take the flyer with them, which would preclude others from reading it.

In certain settings, electronic bulletin boards are an improvement over paper bulletin boards. First, the participants can be physically separated, sometimes by thousands of miles. Second, a user can choose to read messages whenever she has spare time, rather than having to read a flyer while rushing to somewhere else. Finally, a user can copy an electronic bulletin board message or print it out without removing it from the bulletin board.

Unfortunately, electronic bulletin boards have accessibility problems of their own: they require computers as front ends. In poorer communities few people have access to computers. Some groups that have set up public access electronic bulletin boards have simply restricted the set of potential users to people who already have access to computers (e.g., Cleveland Free Net, USENET, PeaceNet.) Other groups have put computers or terminals in public locations (e.g., Community Memory [Levy], New York Youth Network [ChSc], Santa Monica Public Electronic Network [Guthrie et al, Antonoff] .)

A voice bulletin board, on the other hand, need not suffer from such accessibility problems, because it uses a touch-tone telephone rather than a computer as a front-end. A person calls up, navigates through the recorded announcements by pressing buttons on the telephone keypad, and perhaps records a message of her own. That solves three accessibility problems. First, access is mostly not restricted by income, because, in this country, even a very poor family, so long as it has a home, is likely to have a telephone. Second, access is not restricted by time or location, since it is easy to find a public phone even when one is away from home. Third, many people are far more proficient at speaking and listening than at writing and reading: a voice bulletin board does not restrict access by literacy skills.

This paper first describes the information sharing needs of Boston's South End and our design of the Rainbow Pages to meet those needs. Then, we discuss our user interface innovations for voice bulletin boards that, hopefully, will make it easy for callers to use the Rainbow Pages. We present results from a successful use of voice technology for a public information line about Nelson Mandela's visit to Boston in June, 1990. Finally, we discuss our phased introduction plan for the Rainbow Pages itself.

Community needs

We begin with the dual goals of improving the material quality of life for residents of Boston's South End and of enhancing the sense of community. For example, if a resident finds someone to fix his washing machine at a reasonable price or learns about an interesting art exhibit to go to, that improves his quality of life. A sense of community is less tangible: it is largely a matter of self-definition. It occurs when people define themselves and their neighbors in ways that say they are deserving and have resources, when people stick together in hard times, when people have enough pride in their neighborhood that they choose to stay there,

even if they have enough money to move elsewhere. We believe that a system that disseminates information about the skills of neighborhood residents, about community organizations and events, and about neighborhood struggles and achievements can help to accomplish both the material and community-building goals.

Boston's South End is a racially, ethnically, and economically mixed residential community, just a few blocks south of downtown. Its population of about 26,000 includes significant Black, Hispanic, Chinese, Lebanese, and Gay communities. Its housing stock ranges from public housing developments (some run-down, others well-maintained) to modest rental units to gentrified apartments and condominiums. Many residents take pride in the diversity of the South End.

The need for a community information center is best illustrated by an incident that occurred at a tenants' meeting of a public housing development. Mel King led a discussion around issues of community economic development, based on the argument in [CUG] that changes at the micro-economic level are the key to macro-level improvements. He discussed the concepts of import and export of goods and services to and from the neighborhood, then brought up an alternative, trade within the neighborhood. One tenant volunteered that he could fix washing machines for other people in the neighborhood. Another tenant exclaimed that she had been trying to get her machine fixed for six months, but that repair companies had been unwilling to come to the housing development.

At that point, the energy level in the room jumped. Someone else needed a wedding dress for her daughter and found another person in the room not only to sew the dress but to bake the wedding cake as well. One person even offered his expertise at filling out tax forms. There was amazement around the room at how much the 20-25 people had to offer each other.

A community information center can be an electronic marketplace, helping neighborhood residents to make the same kinds of matches that were made at that tenants' meeting. In addition to their positive economic impact, such transactions help to build up the relationships with multiple roles that are a necessary ingredient in establishing a sense of community. If your barber is also in your church and serves on a PTA committee at the school where you are a teacher, as well as being a neighbor who you do handyman jobs for, then there is a chance for community.

Another function of a community information center is to provide information about church and community organizations. Those organizations provide important services in urban settings, including

after-school youth programs, job training, counseling, emergency food aid, and housing construction. Especially for someone who has just moved into a neighborhood, a listing of all the churches and community organizations, and the programs that they sponsor, would be of great value.

A third function of a community information center is to disseminate community news and opinion. The city-wide news media cover only bad news in poorer neighborhoods, usually drugs and crime. Such coverage certainly does not create community pride. In order to get a balanced and informative self-portrait, poorer communities need to create their own news channels. Radio stations and community newspapers are probably the best way to do that, but a community information center can also help. One way is to publicize the school honor rolls, and interesting health care and housing statistics. Another way is to provide a public opinion forum for controversial issues, such as the Boston Police Department's current stop and search policy against youth in Black neighborhoods. An opinion forum could have a similar format to a radio talk show, but also allow for voting on issues that have clear sets of alternatives.

Organizations need a way to publicize events such as tenant meetings, school plays, and so on. Existing methods are adequate but leave much room for improvement. For example, posting flyers outside takes a long time. Sending in listings to newspapers and radio stations requires a lot of lead time. If it is not a big event, the announcement may not be aired at all.

Finally, a community information center can provide a forum for people to share their creativity with each other. The poetry corner is an especially popular feature of the New York Youth Network. Some people also have special talents as joke or story tellers that they can share. Group games, such as fictionary, in which people make up fake definitions for words, may also be appropriate.

Overall, a community information center can help people find events, organizations, community news, goods and services. All of these functions are of immediate benefit to the people who use the information center. These functions also have the potential to improve the sense of community: they help people to meet each other, to get a sense that the neighborhood has human resources and is a place where "things are happening."

Application Design

With these community needs in mind, we have designed a community information center, the Rainbow Pages, as shown in Figure 1. To illustrate how users would find and record information, consider two scenarios: a first-time caller exploring the system and an experienced user calling to record event announcements for an organization.

Consider a first-time caller who is told by a friend that a lot of useful services are available at low rates. He is given the phone number and goes home to try it. He calls and hears a welcoming announcement in five languages. He understands the English welcoming message with some difficulty but is relieved to hear (in Spanish) that he can press **3** to get the rest of the prompts in Spanish. He does so, and the system now recites the second layer menu in Spanish. The user presses **1** for Classified Ads, then **3** for Services Offered. At that point, other people's recorded offers of services are presented in the form of a list through which the user can skip forward and backward[1].

This scenario, then, demands that a user, without the aid of any instruction or written materials, be able to access information. If the user's friend gives him some instruction, such as, "Press 3 as soon as you hear it start talking, so you can get everything in Spanish," then he can get started even more quickly. Similarly, if the user consults written materials that we will distribute widely in the community, he will have an easier time choosing the correct branches to take. Thus, with no aids, a novice user can follow the prompts to get started, but can do even better with spoken or written instructions.

Now consider the scenario of the experienced user who is making her bi-weekly call to record announcements for her community organization. As soon as the system answers her call, she presses **3-2-#-5-1-7-#-3**. The first two digits choose Spanish for the prompts and navigate her to the branch for the Directory of Community Organizations. # initiates entering in the id number for her organization, which is 517, and the second # terminates entry of the id number. That skips her forward in the directory to her organization's listing. The final **3** indicates that she would like to add or change information associated with the organization. She is

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[1] Over time, there might be enough offerings in a category to warrant splitting it into sub-categories. It is better to add sub-categories as needed than to create many empty sub-categories initially.

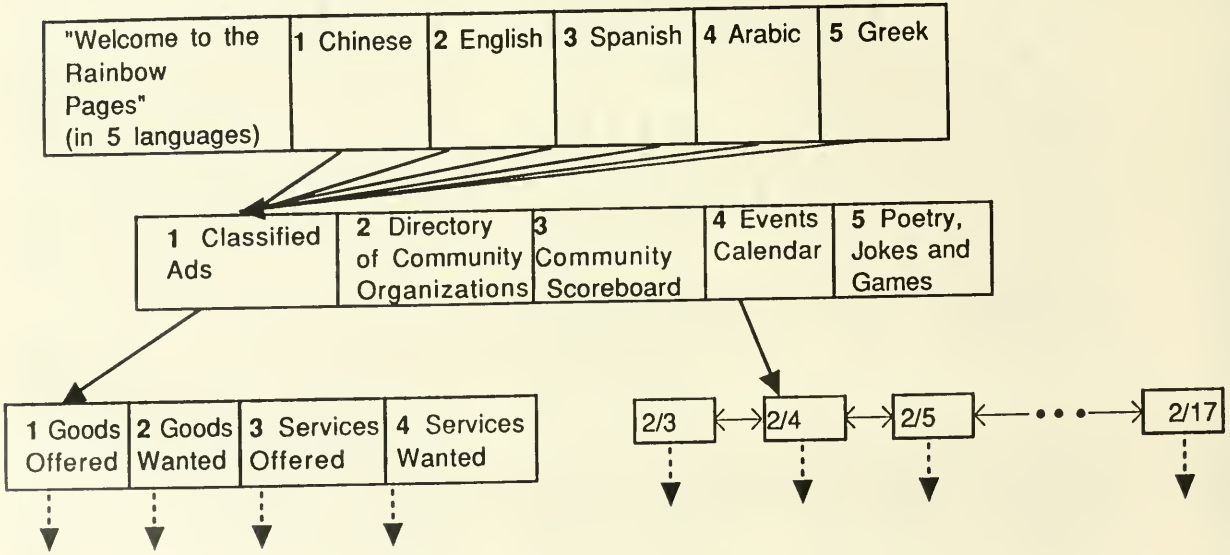

Figure 1: the layout of the Rainbow Pages Community Information Center as it would be presented to the user on February 4 (the Events Calendar changes each day.) Callers start at the top left, then press touch tone buttons to navigate to the information that interests them.

prompted to enter a password, then is allowed to record event announcements.

Each event announcement is a semi-structured object [Malone et al., SchAr]. The user fills in an "auditory form" with entry blanks for the date, a short description (less than 10 seconds), a longer description, the sponsoring organization, the location, and a contact person and phone number. The user speaks the information for most of the entry blanks, but keys in the date with touch tones, so that the Events Calendar can sort events by date. The sponsoring organization is filled in automatically, since she has already entered in the password for her organization. Her event announcements can then be accessed by future callers either from the Events Calendar for the appropriate date, or through the Directory of Community Organizations.

Overall, the Rainbow Pages is designed to be used by a beginner with no aids, but to gracefully allow users to learn more advanced features and take advantage of written instructions. The eventual goal is to have a two page instruction manual, including one page for Figures 1 and 2, and a business-card sized summary.

User Interface Innovations

While voice bulletin boards offer accessibility advantages over other electronic bulletin boards, it is harder to design a good interface for a voice bulletin board. With a visual interface, the user can see a whole screenful of text at once. For example, with a visual interface the user might see all of Figure 1 when making a choice at the top level. By contrast, existing audio interfaces are strictly serial, speaking one word at a time.[2] A second difficulty is that many people can read a sentence silently much faster than it can be read aloud. Together, these two deficiencies amount to a bandwidth problem: it takes much longer to present the same amount of text through auditory than through visual channels. One final difficulty for telephone interfaces is that there are only twelve buttons available for the user to enter commands.

Some of these difficulties are readily apparent in the current generation of telephone-based interfaces, which use numbered menus. For example, a telephone banking system might recite: "Press one for account update, two

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[2] Note that this may not be an inherent limitation of audio interfaces. After all, people do manage to do at least some processing of multiple conversations at cocktail parties.

for check update, three for account balances..." Such a menu can be effective if the options decompose nicely into distinct categories with short descriptions. Otherwise, the user needs to listen through the whole menu before deciding which option is appropriate. By then, she may have forgotten whether to press **1** or **2** for account update.

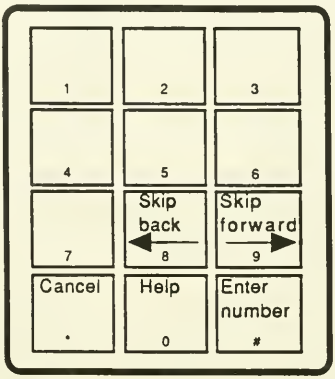

Figure 2: The telephone keypad commands. Buttons 1 through 6 are reserved for numbered menu options.

We have made improvements to purely menu-based interfaces that give the user more control and allow better use of the limited available bandwidth. Telephone keys **1** through **6** are still used for numbered menu choices. Keys 8 and 9, respectively, are used to skip backward and forward by one message (Figure 2). * allows the user to move back up to the previous menu. Our keypad layout follows many of the design guidelines in [Norman], such as using "natural mappings" (the skip back button is to the left of the skip forward button) and drawing on existing social conventions (dial the operator for help.)

The reservation of **8** and **9** as arrow keys allows the use of lists and other structures besides menus. For example, structuring the event announcements for a given day as a list has several advantages over creating a menu with a number for each event. First, it matches the usual way of presenting events in newspapers and newsletters. Second, the user need not listen for the numbers associated with the event names, but can concentrate on the contents of the announcements instead. Third, the user chooses how much of each announcement to hear (**8** and **9** are available to interrupt boring announcements) instead of the designer choosing how long to make the menu prompts. Finally, using the list avoids the need for an additional layer in the tree structure of Figure 1, which should make it easier for users to keep track of where they are.

The use of audio forms for semi-structured input has several advantages. The user is reminded separately of all the important pieces of information to record. the system can change the order or the selection of which parts to play back, depending on the context. For example, in a list of events sponsored by an organization, the organization's name need not be repeated each time, while it should be repeated when the announcements are accessed through the events calendar, where they are mixed in with events sponsored by other organizations. By piecing together parts of different messages, it is also possible to automatically provide a form of context-sensitive help. Finally, the symbolic input of some information, such as the date of an event, allows the system to sort the recorded announcements in appropriate ways, and even to take such actions as deleting old announcements.

Preliminary Results: the Mandela Visit

While the Rainbow Pages has not yet been deployed, a similar system was used as a public information about Nelson Mandela's visit to Boston on June 23, 1990. Results were encouraging. The system answered nearly 1400 calls in the ten days prior to Mandela's visit, dispensing information about the schedule of events and allowing callers to leave their names and addresses if they wanted to volunteer. More than 200 did so. 78% of the callers pressed at least one button after calling, even though the publicity did not state that touch-tone phones were required. This indicates that a large majority of Bostonians have touch-tone telephones. Inspection of the usage log and interviews with a few people who called the system indicate that they were able to learn the use of buttons **8** and **9** to move between items in a list, and liked the feeling of control that it gave them.

Despite the success of that experiment, some essential aspects of the Rainbow Pages remain untested. The general public was not asked to use audio forms for volunteer registration, so it is not yet clear if they can be made comprehensible to the first-time caller. We do not know yet how the problem of finding relevant information will scale up when there is a large amount of information recorded by many callers.

Community Introduction Plan

We have developed a community introduction plan that we hope will improve the chances of gaining popular acceptance for the Rainbow Pages. The major goals of the introduction plan are to test and improve the user interface, revise the structure of the information center to more closely match community needs, and to gather sufficient postings so that the

system will contain useful recordings when it is first widely publicized. A secondary goal of the introduction plan is to identify and train individuals to maintain the bulletin boards. Maintenance includes deleting obsolete and inappropriate messages and moderating/editing the news and opinion sections. The introduction plan attempts to draw on the existing resources of the South End.

The United South End/Lower Roxbury Community Development Corporation (UDC), has agreed to help with initial user interface testing. Through their contacts, they will find volunteers from the community. We will seed a restricted version of the Rainbow Pages with information and ask the volunteers to perform retrieval and recording tasks while we observe them. We will then revise the interface as needed.

We will attempt to involve other community organizations prior to a public announcement of the system. At a minimum, we would like to have a recorded directory of all of the organizations and the programs that they offer. We will also ask for feedback on the overall structure, as to whether it meets their perceptions of the community's needs. Finally, we will ask them to record announcements of events just after the official unveiling of the system.

Once we have built up a base of information in the system during the pilot testing phase, we will announce the system publicly. This will include press releases to local media, posting of flyers on the streets and in local businesses and community organizations, and speaking appearances any place that will have us. Following this initial publicity blitz, we will publicize statistics on system usage. Hopefully, the individuals and organizations who have recorded information will continue to do so if their recordings have been listened to frequently.

At least initially, we will maintain the system ourselves. During the introduction process, however, we will be looking for a group of people that can take over maintenance tasks on a longer-term basis. One idea is to recruit a youth group, either through a school, a community organization, or a church, to take on the responsibilities. For example, a communications class in a community college or high school could gain experience in reporting local news, in public speaking, and in using computer technology.

Technology and System Status

One of the exciting aspects of the Rainbow Pages is that the hardware and system software necessary for a voice bulletin board with space for 9

hours of recorded speech can be purchased for about $2000, and prices are coming down every month. The required hardware is an IBM AT-compatible PC with a large-capacity hard disk and a commercially available voice card. A telephone line plugs into the voice card, which performs such functions as detecting touch-tones and digitizing speech that comes in over the telephone line so that it can be stored on the computer's hard disk. The software for the Rainbow Pages is written in C.

If the Rainbow Pages is successful in Boston's South End, we hope to replicate it in other neighborhoods. People in other communities will be able to call up the South End bulletin board to explore the possibilities it offers, which should facilitate the spread of the technology. The low price tag should help, too.

Conclusion

The chorus of calls for community-based computing initiatives is a three part harmony. One voice calls for community-based organizations to be effective users of computers, in the form of database, spreadsheet, and desktop publishing technology. Another voice sounds that people in disadvantaged communities should not be just users, but should learn computer skills so that they can get the good jobs that, increasingly, are available only to the computer literate. The third voice claims that people in disadvantaged communities should have access as users to the benefits of computer technology, such as communication networks, news services, and databases of toxic waste locations. This paper falls in the last camp. In particular, we are trying to bring the benefits of a communication network, in the form of a voice bulletin board, to a neighborhood in Boston, using the existing technology base of touch-tone telephones.

In the book Chain of Change, King charts the stages of the struggles for Black Community Development in Boston, from the service stage, to the organizing stage, to the institution-building stage. He argues that the next stage requires a struggle for minds as well as for material resources. When a community *believes* that it has skills and internal resources, it will be able to lobby for its share of external resources and make effective use of the resources it acquires.

The Rainbow Pages will help people to find out about each other and about their neighborhood. Such information can improve the quality of life for the individuals who get the information, and increase the self-sufficiency of the neighborhood. We also believe that such information is one key in the struggle for minds that enables a neighborhood to become an empowered community. The experiment is just beginning: stay tuned.

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Contact Information

Community Memory. Early incarnations of the Community Memory project in Berkeley, CA are described in [Levy]. The project has recently been rejuvenated and now has 10 networked Personal Computers at public locations, including libraries and a laundromat. For more information contact Tom Nemcik, Community Memory, 2617 San Pablo Avenue, Berkeley, CA 94702. Phone: (415) 841-1114. Email: think!cdp!tnemcik

New York Youth Network. This network connects youths in New York City via personal computers in public-access community computing centers. Contact Seth Chaiklin, Institute for Learning Technologies, Teachers College, Columbia University, New York, NY 10027. Email: ny-yn!seth@hombre.masa.com